F1-071

Executive Summary

Project Title: Upper Sacramento River Watershed Water Temperature Assessment

Applicant: Gerald Boles

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Approach: Continuously recording temperature recorders will be installed in the Sacramento River and in major tributaries to the upper river. Systematic, continuous, long-term data will be developed that identify salmon passage, spawning, and rearing issues related to water temperature. Water temperature will be assessed since this parameter controls the rate of chemical and biological processes, has often been significantly altered from stream management activities (such as dams and diversions), and is of utmost importance in determining the suitability of a water body for survival and reproduction of anadromous fish. These data will be used by a variety of agencies and groups to implement amelioration activities to improve habitat conditions related to stream temperatures.

A total of 113 thermographs will be installed and maintained at 13 sites on the Sacramento River and in 18 tributaries. The project will begin upon execution of a contract and is proposed to continue for a three year period with annual progress reports.

Justification: The Ecosystem Restoration Program Plan, Volume 1, Visions for Ecosystem Elements states that "streamflow and temperature should be accurately monitored and rapidly evaluated for both short-term and long-term management decisions. This basic streamflow information will then allow for flexible management of streamflows." The ERPP also lists as an Implementation Objective the action of "restoring stream temperature monitoring capability at several U. S. Geological Survey stream gages and other strategic locations of Central Valley streams ... to provide a solid basis for adaptive stream temperature management decisions." This proposed project meets the objectives of the ERPP.

Several agencies collect water temperature data for local projects, but these data are limited in scope, coverage, and reliability. Without accurate systemwide temperature data, environmental effects to migrating, spawning, and rearing salmon and steelhead cannot be realistically determined, nor can mitigation be developed until the scope of the problem is defined. The water temperature data are also needed for corroboration of temperature models being developed.

Budget Costs: The total annual cost for this project is $80,000. Cost sharing from the Department of Water Resources reduces the contribution from CalFed to $60,000 per year, for a total project cost to CalFed of $180,000 for the three year project.

Third Party Impacts: There are no third party impacts associated with the conductance of this project.

Applicant Qualifications: The project manager and field staff have many years of experience with the Department of Water Resources conducting similar projects. The Department has all necessary equipment to conduct the project.

Monitoring and Data Evaluation: Data generated from this project will establish baseline water temperature conditions for the Sacramento River and tributaries in the upper watershed. These data will be used to determine present effects from stressors to instream aquatic habitat and priority species, and to determine effectiveness of watershed management and mitigation activities. Data from the proposed project will be compared to historic data that is available to determine long-term changes that may have occurred. Data will also be compared with criteria established for protection of aquatic life to determine areas of streams where water temperatures adversely affect salmon, steelhead, and other aquatic species.

Support/Coordination: Data from the proposed assessment program will be used by the Department of Fish and Game, Regional Water Quality Control Board, Central Valley Project and State Water Project operators, and other agencies and groups.

Compatibility with CalFed Objectives: This project addresses water quality problems which adversely impact high-risk aquatic species and their habitats, including spring-run and late-fall run chinook salmon, steelhead trout, and instream aquatic habitat. The project also provides information necessary for actions to improve and increase aquatic habitats and improve ecological functions, consistent with the objectives in the Ecosystem Restoration Program Plan.

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Type of Organization: State Government
(Tax Exempt)

Implementation Participants and Collaborators
CalFed Bay-Delta Program
Department of Fish and Game

RFP Project Group Type: Other Services

July 16, 1997

Project Description

Project Description and Approach: Systematic, continuous, long-term data will be developed that identify salmon passage, spawning, and rearing issues related to water temperature. Water temperature will be assessed since this parameter controls the rate of chemical and biological processes, has often been significantly altered from stream management activities (such as dams and diversions), and is of utmost importance in determining the suitability of a water body for survival and reproduction of anadromous fish. These data will be used by a variety of agencies and groups to implement amelioration activities to improve habitat conditions related to stream temperatures.

Continuously recording temperature recorders will be installed in the Sacramento River and in major tributaries to the upper river. Thermographs will be installed at the mouth of each tributary and at intervals to the upper reaches where salmonid spawning and rearing occur. Station intervals will be designed to provide sufficient information to assess warming with stream distance from the upper reaches to the mouth.

Thermographs will be serviced once each month to obtain data and ensure continued proper operation. Data will be loaded directly from the thermographs to computer spreadsheets. Thermograph data will be available for management decisions to anyone requesting the data.

Location of Project: The proposed project includes the Sacramento River from Verona to Keswick Dam and major tributaries in the upper watershed. Tributaries in which thermographs will be installed are:

- Deer Creek
- Elder Creek
- Bear Creek
- Big Chico Creek
- Cottonwood Creek
- Paynes Creek
- Clear Creek
- Feather River
- Yuba River
- Battle Creek
- Mill Creek
- Thomes Creek
- Stony Creek
- Butte Creek
- Antelope Creek
- Cow Creek
- Bear River
- Colusa Basin Drain

Thermographs in the Sacramento River will be installed near Verona, Knights Landing, Colusa, Butte City, Hamilton City, Woodson Bridge, Tehama, Red Bluff, Bend Bridge, Jelleys Ferry, Balls Ferry, Anderson, and Keswick Dam.

Expected Benefit: Continuously recorded long-term temperature data in the Sacramento River and its tributaries are necessary to identify salmon passage, spawning, and rearing issues related to water temperature. These data will be used by a variety of agencies and groups to implement amelioration activities to improve habitat conditions related to stream temperatures. The Ecosystem Restoration Program Plan, Volume 1, Visions for Ecosystem Elements states that "streamflow and temperature should be accurately monitored and rapidly evaluated for both short-term and long-term management decisions. This basic streamflow information will then allow for flexible management of streamflows." The ERPP also lists as an Implementation

Objective the action of "restoring stream temperature monitoring capability at several U. S. Geological Survey stream gages and other strategic locations of Central Valley streams ... to provide a solid basis for adaptive stream temperature management decisions." This pro-posed project meets the objectives of the ERPP.

The proposed project will provide information about system stressors in the Sacramento River watershed which affect priority aquatic species and their habitats. The stressors for which this project will provide valuable information include: 1) alteration of flows and other effects of water management, including hydrograph alterations, migration barriers and straying; 2) water quality; 3) water temperature; and 4) land use, including grazing, forestry, and agricultural practices. Natural flows in the Sacramento River watershed are altered by impoundments on rivers and streams, diversion of water for irrigation, and return flows from irrigated agriculture. These alterations to the natural flow adversely affect temperature and water quality. Adverse conditions created by hydrograph modification, especially as related to water temperature modification, result in delaying or blocking migration by anadromous fish. Water temperatures, especially during lower flows, may adversely affect the ability of the Sacramento River and tributaries to provide suitable migration, spawning, and nursery habitat for anadromous fish as well as other aquatic species.

The habitat type affected by stressors in the Sacramento River watershed is primarily instream aquatic habitat. The priority species in this habitat type affected by stressors in the watershed include spring-run, fall-run, and late-fall-run chinook salmon and steelhead trout. This project will provide primary benefits to this habitat type and these species by identifying temperature impairments that are limiting the quality of the habitat and reducing survival of these species. The project provides secondary benefits for adaptive management by establishing baseline conditions to evaluate the effects of other mitigation and amelioration activities that occur in the watershed, as well as for operation of water impoundment and diversion facilities. The project also provides data important for refining efforts to develop temperature models for the Sacramento River and provides basic data for watershed planning and management.

Background and Biological/Technical Justification: Water temperatures in the Sacramento River watershed have been altered from many activities, including construction and operation of dams, removal of riparian vegetation, diversions which reduce streamflows, and discharges from agricultural drains. Temperatures are often much higher than those occurring prior to alteration, and have produced significant effects to anadromous fish. Many fish behavior and physiological functions, such as spawning, are controlled by temperature. Salmon and steelhead require a temperature range between 54° to 57° F for spawning, while their eggs require temperatures below 57° F for proper development. Growth of juvenile salmon and steelhead is generally optimal in the temperature range of 50 to 60° F.

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However, temperatures in the Sacramento River and in tributaries are often unsuitable for successful holding of adult salmon and steelhead fish, spawning, egg incubation, and juvenile rearing due to stream alterations that have affected the temperature regime.

Efforts are underway to alleviate adverse temperature conditions, such as with the modification of the water release facilities at Shasta Dam, as well as to model temperatures in the Sacramento River. Data are necessary to determine the effects of these projects on river temperatures, refine the accuracy of temperature models, and determine where adverse water temperatures are impacting anadromous fish. Stream temperature management actions require accurate data on current resource conditions to determine planning decisions and to monitor the success of those decisions.

While the USGS at one time maintained temperature recorders at many of their stream gaging stations, budget cutbacks over the past couple of decades have resulted in the elimination of this activity. Currently, only the Department of Water Resources systematically collects temperature data from stations in the Sacramento River watershed. The Department of Fish and Game has some thermograph data from Deer and Mill creeks, but currently does not have any thermographs in place due to flood losses. Several agencies collect data for local projects, but these data are limited in scope, coverage, and reliability. Additional systemwide, uniform, and reliable data are needed for temperature management of the Sacramento River and its tributaries. Without accurate systemwide temperature data, environmental effects to migrating, spawning, and rearing salmon and steelhead cannot be realistically determined, nor can mitigation be developed until the scope of the problem is defined.

Proposed Scope of Work: Water temperature recorders will be installed at each of the Sacramento River stations and at sufficient intervals in the listed tributaries to provide information on current water temperature conditions, effects of management actions, and areas of the streams with temperature conditions adversely affecting salmonid migration, reproduction, and rearing. Recorders will log data at 15 minute intervals. Recorders will be serviced at monthly intervals, or more frequently to insure continued proper operation during extreme conditions such as high flow events. Data stored on the electronic recorders will be transmitted to portable computers in the field, verified for proper operation and accuracy, and subsequently transferred to office desktop computers for data archiving.

Data will be accessible through the Department's WEB page or FTP transfer. Data will also be available via computer floppy disk or hardcopy. Both 15 minute interval data and daily minimum-mean-maximum data will be available to requestors. Annual reports will document stream temperature conditions to focus management and restoration efforts.

Progress reports will be made to the CalFed Bay Delta Program and other interested parties at agreed upon

intervals. The project is proposed to continue for three years.

Monitoring and Data Evaluation: Data generated from this project will establish baseline water temperature conditions for the Sacramento River and tributaries in the upper watershed. These data will be used to determine present effects from stressors to instream aquatic habitat and priority species, and to determine effectiveness of watershed management and mitigation activities.

Data from the proposed project will be compared to the sparse historic data that is available to determine long-term changes that may have occurred. Data will also be compared with criteria established for protection of aquatic life, including the temperature requirements for holding, spawning, incubation, and rearing of salmonids. Data from the proposed assessment program will be used by the CalFed Bay-Delta Program, Department of Fish and Game, reservoir operators, and others to support management and planning decisions

Implementability: The Department of Water Resources has sufficient resources to conduct the proposed program. No environmental or other permits are required. Access permission to private property has been obtained for other work being conducted by the Department or will be obtained as necessary for the proposed project. Access to temperature monitoring sites is generally via paved roads or improved dirt roads. There are no impediments to the successful completion of this project.

Costs and Schedule to Implement Proposed Project

Budget Costs: A temperature recorder will be installed at each station on the Sacramento River and, on average, five sites in each tributary, for a total of 113 thermographs. Costs for direct salary and benefits, overhead, and materials are estimated at $80.000 per year (Table 1). The California Department of Water Resources has $20,000 per year that will be used to partially fund this project. Additional funds of $60,000 per year are required to cover the remaining unfunded data collection and analyses activities for this assessment project. The total requested allocation for the three year water temperature assessment of the Sacramento River and tributaries is $180,000.

Schedule Milestones: The Department of Water Resources has thermographs installed at most of the proposed Sacramento River temperature monitoring sites. These thermographs have been in place since 1991. Extremely numerous requests have been received for this data from government agencies, university researchers, and consultants working on temperature related issues in the Sacramento River watershed. Additional temperature monitoring and assessment in the Sacramento River and tributaries cannot begin until additional funding is secured. Temperature recorders and data collection and analyses will begin immediately upon contract execution for the additional funding.

Third Party Impacts: No direct third party impacts are associated with this project. However, third parties may be affected as the results of this watershed assessment project are used to remediate sources of impairment. Third parties may bear some of the costs of remediation, or additional grants will be needed to remediate impairment. The extent of costs for remediation of impairments cannot be determined until the proposed project is implemented and results are obtained.

Applicant Qualifications

The project will be conducted by staff of the Northern District of the California Department of Water Resources. The project will be directed by Gerald Boles, who is Chief of the Water Quality and Biology Section in the Northern District. Gail Kuenster, an Environmental Specialist II in the Water Quality and Biology Section, will be the lead investigator responsible for field sample collection and data archiving and analyses under direction of the project director. General administrative functions, such as accounting, billing, and contract administration, will be conducted by the Northern District's Administrative Officer, Barbara Polson.

The CalFed Bay-Delta Program and the Department of Fish and Game staffs are the primary participants that will help guide the program. These agencies will review project progress and results, and make recommendations concerning direction for the project.

Biosketches: Gerald Boles has been the supervisor of the Water Quality and Biology Section in the Northern District of the Department of Water Resources since 1990, and has been conducting water quality studies for the Department since 1975. He has a B.A. degree in Microbiology (minor in Chemistry) and a M.A. degree in Biological Sciences. In addition to years of experience with budgets and general supervisory functions, he has supervised and conducted numerous water quality investigations. He is responsible for both the Water Quantity and Quality Measurement Program and the Water Quality Evaluation Program in the Northern District. His duties have required him to develop and implement studies and research projects to determine environmental effects on water quality, wildlife, plants, and fisheries associated with future water supply projects, geothermal development, weather modification, water transfers, and other projects. Some of the projects for which he has been directly responsible include assessment of impacts to the aquatic macroinvertebrate community following the metam sodium chemical spill in the upper Sacramento River in 1991, development and implementation of a water quality assessment program at Lake Almanor in cooperation with Plumas County, long-term water quality monitoring at both Clear and Eagle lakes, evaluation of effects to aquatic resources from cloudseeding in the upper Feather River area, groundwater quality assessments in the Sacramento Valley, Eagle Lake, and Cady Springs areas, and assessment of factors affecting the water quality of a drinking water supply reservoir. References include Steve Turek, Department of Fish

and Game, 2440 Athens Avenue, Redding, California; Lauri Zander, Lahontan Regional Water Quality Control Board, 2501 Lake Tahoe Boulevard, South Lake Tahoe, California; Laura Barnthouse, Plumas County Environmental Health Department, P.O. Box 545, Chester, California; and Dennis Heiman, Central Valley Regional Water Quality Control Board, 415 Knollcrest Drive, Suite 100, Redding, California.

Gail Kuenster has been employed by the Department of Water Resources since 1995. With both a B.A. and M.S. degree, she has been extensively involved in the District's water quality monitoring program, as well as thermograph maintenance and data acquisition, aquatic macroinvertebrate collection, and database administration. She currently is responsible for the collection and processing of thermograph data that the Department is collecting from the Sacramento River. References include Linnea Hanson, U. S. Forest Service, Oroville Ranger District, Oroville, California; Dr. Rob Schlising, Biology Department, California State University, Chico, California; and Lawrence Janeway, U. S. Forest Service, Oroville Ranger District, Oroville, California.

Compliance with Standard Terms

As a public agency, all standard terms and conditions will be approved at signing of the contract. No forms are necessary for submission with this proposal per Table D1 of the RFP.

Table 1. Annual Cost distribution for temperature monitoring in the Sacramento River watershed

Project Task	Direct Labor Hours	Direct Salary & Benefits	Overhead Labor	Service Contracts	Material & Acquisition	Miscellaneous	Total Cost
Thermograph Installation	160	3,520	4,640	0	16,000	544	24,864
Thermograph Maintenance	1,320	29,040	38,280	0	0	0	68,640
Data Management	48	1,056	1,392	0	0	0	2,496
Total Program Costs	1,528	33,616	44,312	0	0	544	80,000

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